



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 11:00 AM EDT

PDB ID : 4LRS / pdb_00004lrs
Title : Crystal and solution structures of the bifunctional enzyme (Aldolase/Aldehyde dehydrogenase) from *Thermomonospora curvata*, reveal a cofactor-binding domain motion during NAD⁺ and CoA accommodation within the shared cofactor-binding site
Authors : Fischer, B.; Branlant, G.; Talfournier, F.; Gruez, A.
Deposited on : 2013-07-20
Resolution : 1.55 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references](#) ①) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

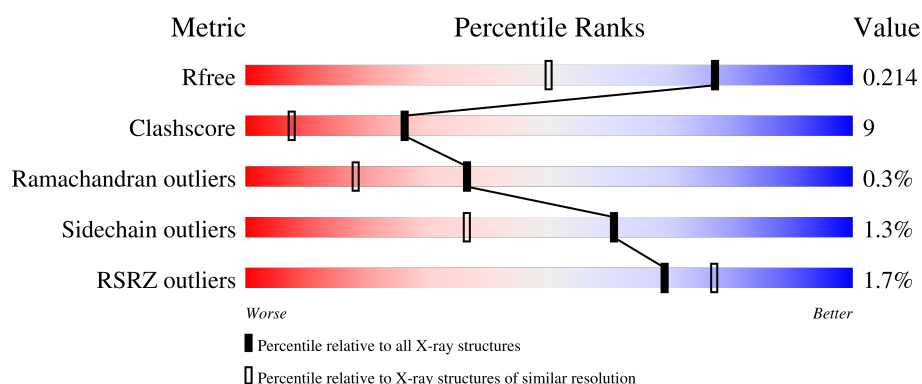
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.55 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	2145 (1.56-1.56)
Clashscore	190562	2189 (1.56-1.56)
Ramachandran outliers	187476	2153 (1.56-1.56)
Sidechain outliers	187428	2150 (1.56-1.56)
RSRZ outliers	180081	2146 (1.56-1.56)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	355	84% 10% 5%
2	B	323	80% 11% 9%
3	N	3	100% 100%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
11	FOR	B	410	-	-	X	-
8	GOL	B	405	-	-	X	-
9	PEG	A	406	-	-	X	-
9	PEG	A	408[B]	-	-	X	-
9	PEG	B	409	-	-	X	-

2 Entry composition

There are 12 unique types of molecules in this entry. The entry contains 5807 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called 4-hydroxy-2-oxovalerate aldolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	337	Total	C	N	O	S	9	26	0
			2715	1687	505	514	9			

- Molecule 2 is a protein called Acetaldehyde dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	294	Total	C	N	O	S	9	22	0
			2360	1489	411	448	12			

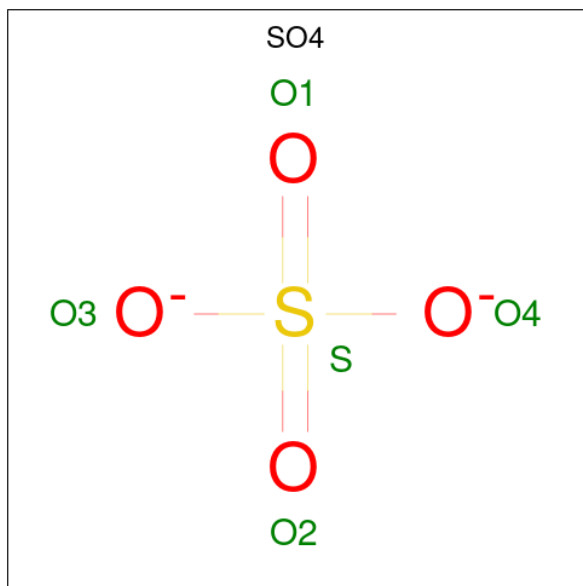
There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	initiating methionine	UNP D1A3K7
B	2	GLY	-	expression tag	UNP D1A3K7
B	3	SER	-	expression tag	UNP D1A3K7
B	4	SER	-	expression tag	UNP D1A3K7
B	5	HIS	-	expression tag	UNP D1A3K7
B	6	HIS	-	expression tag	UNP D1A3K7
B	7	HIS	-	expression tag	UNP D1A3K7
B	8	HIS	-	expression tag	UNP D1A3K7
B	9	HIS	-	expression tag	UNP D1A3K7
B	10	HIS	-	expression tag	UNP D1A3K7
B	11	SER	-	expression tag	UNP D1A3K7
B	12	SER	-	expression tag	UNP D1A3K7
B	13	GLY	-	expression tag	UNP D1A3K7
B	14	LEU	-	expression tag	UNP D1A3K7
B	15	VAL	-	expression tag	UNP D1A3K7
B	16	PRO	-	expression tag	UNP D1A3K7
B	17	ARG	-	expression tag	UNP D1A3K7
B	18	GLY	-	expression tag	UNP D1A3K7
B	19	SER	-	expression tag	UNP D1A3K7
B	20	HIS	-	expression tag	UNP D1A3K7

- Molecule 3 is a protein called Symmetric aldolase, C-terminal disordered residues.

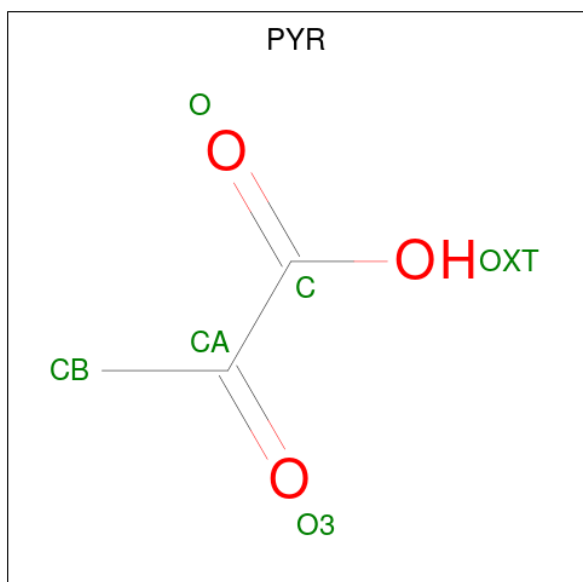
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	N	3	Total	C	N	O	0	0	0
			15	9	3	3			

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is PYRUVIC ACID (CCD ID: PYR) (formula: C₃H₄O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		

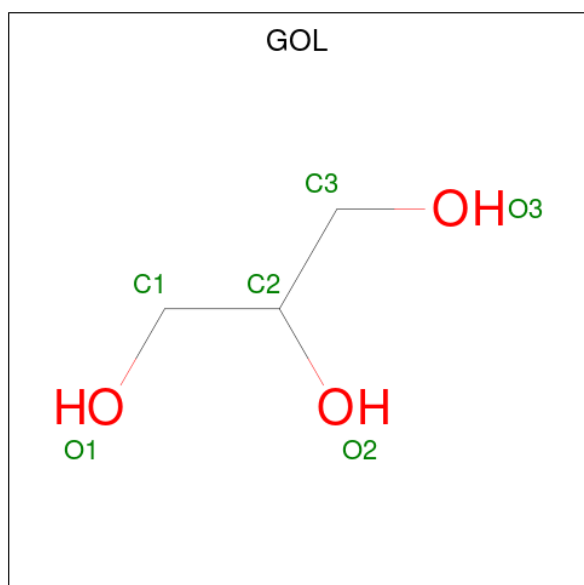
- Molecule 6 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	Cl		0	0
			1	1			
6	B	1	Total	Cl		0	0
			1	1			

- Molecule 7 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	Mg		0	0
			1	1			

- Molecule 8 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



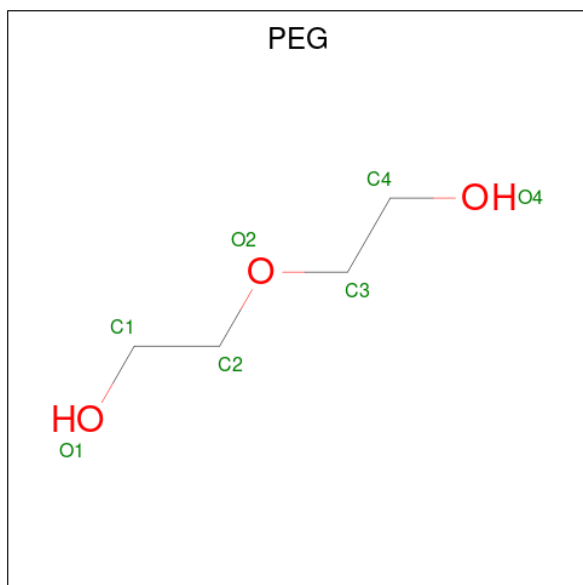
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	A	1	Total	C	O	0	0
			6	3	3		
8	B	1	Total	C	O	0	0
			6	3	3		
8	B	1	Total	C	O	0	0
			6	3	3		

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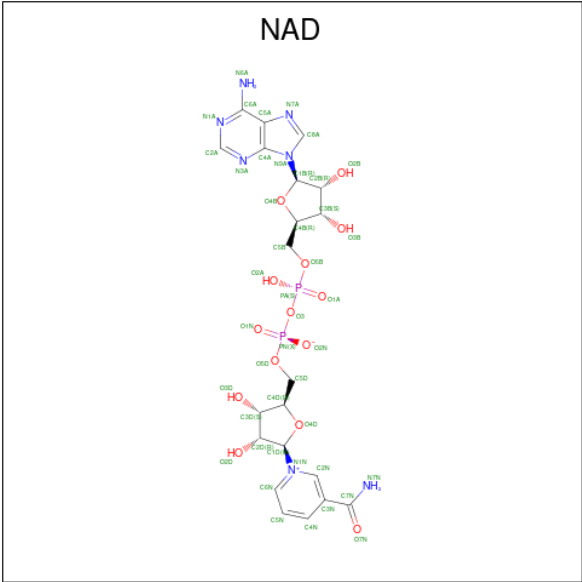
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total	C	O	0	0
			6	3	3		
8	B	1	Total	C	O	0	0
			6	3	3		
8	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 9 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



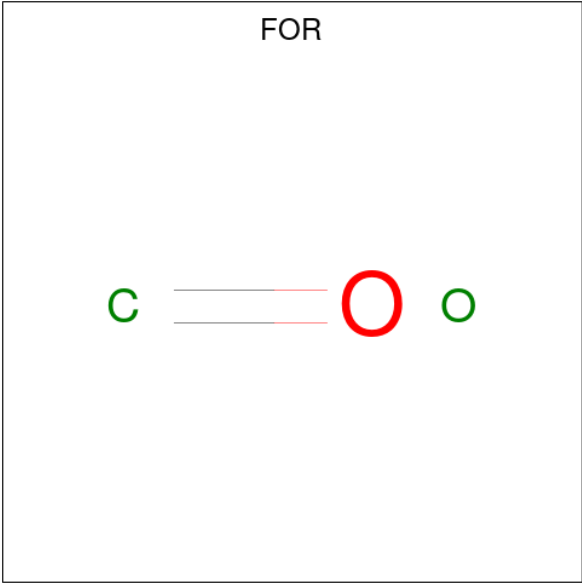
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	A	1	Total	C	O	0	0
			7	4	3		
9	A	1	Total	C	O	0	0
			7	4	3		
9	A	1	Total	C	O	0	1
			14	8	6		
9	A	1	Total	C	O	0	0
			7	4	3		
9	A	1	Total	C	O	0	0
			7	4	3		
9	B	1	Total	C	O	0	0
			7	4	3		
9	B	1	Total	C	O	0	0
			7	4	3		

- Molecule 10 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (CCD ID: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
10	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 11 is FORMYL GROUP (CCD ID: FOR) (formula: CH₂O).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
11	B	1	Total	C	O	0	0
			2	1	1		

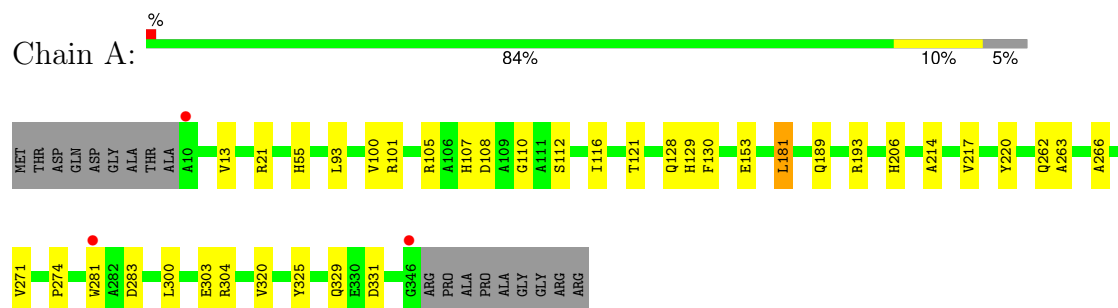
- Molecule 12 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	296	Total 296	O 296	0	0
12	B	265	Total 265	O 265	0	0
12	N	4	Total 4	O 4	0	0

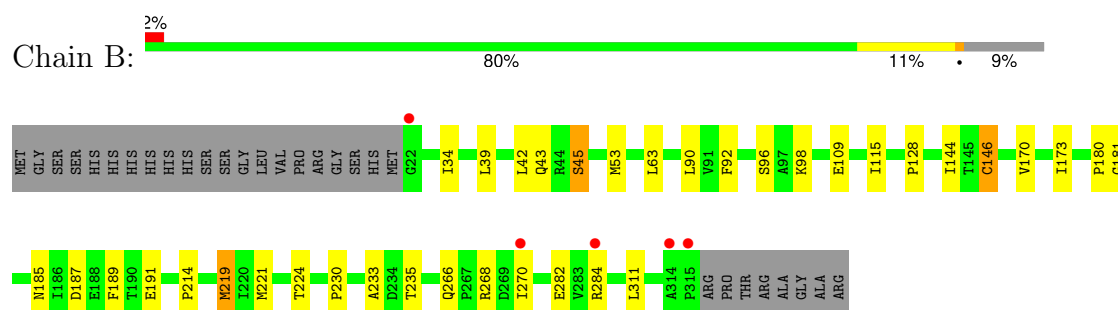
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

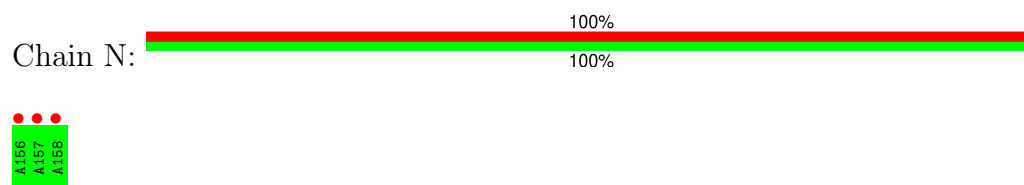
- Molecule 1: 4-hydroxy-2-oxovalerate aldolase



- Molecule 2: Acetaldehyde dehydrogenase



- Molecule 3: Symmetric aldolase, C-terminal disordered residues



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	149.88Å 92.21Å 56.48Å 90.00° 100.59° 90.00°	Depositor
Resolution (Å)	25.00 – 1.55 25.00 – 1.55	Depositor EDS
% Data completeness (in resolution range)	97.7 (25.00-1.55) 97.7 (25.00-1.55)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.22 (at 1.55Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.164 , 0.200 0.190 , 0.214	Depositor DCC
R_{free} test set	5337 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	18.4	Xtriage
Anisotropy	0.475	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 47.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5807	wwPDB-VP
Average B, all atoms (Å ²)	12.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.43% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FOR, PEG, GOL, NAD, PYR, MG, SO4, CL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.87	3/2776 (0.1%)	0.86	0/3768
2	B	0.72	1/2418 (0.0%)	0.79	1/3303 (0.0%)
3	N	0.62	0/14	0.54	0/18
All	All	0.80	4/5208 (0.1%)	0.83	1/7089 (0.0%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	96	SER	C-O	-6.00	1.16	1.23
1	A	206	HIS	CE1-NE2	5.97	1.38	1.32
1	A	55	HIS	C-O	-5.31	1.17	1.23
1	A	181	LEU	C-O	-5.20	1.17	1.24

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	128	PRO	N-CA-C	6.34	118.44	110.70

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2715	0	2665	52	0
2	B	2360	0	2390	40	0
3	N	15	0	14	0	0
4	A	5	0	0	0	0
5	A	6	0	0	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
7	A	1	0	0	0	0
8	A	6	0	8	0	0
8	B	30	0	40	7	0
9	A	42	0	60	16	0
9	B	14	0	20	11	0
10	B	44	0	26	11	0
11	B	2	0	0	3	0
12	A	296	0	0	5	0
12	B	265	0	0	4	0
12	N	4	0	0	0	0
All	All	5807	0	5223	99	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 9.

All (99) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:146[A]:CYS:SG	10:B:401:NAD:C4N	2.35	1.15
1:A:101[B]:ARG:HH11	1:A:101[B]:ARG:HG3	1.15	1.08
2:B:180:PRO:HB2	9:B:409:PEG:H42	1.43	1.00
10:B:401:NAD:H2B	9:B:409:PEG:H32	1.48	0.96
1:A:101[B]:ARG:HH11	1:A:101[B]:ARG:CG	1.83	0.91
1:A:101[A]:ARG:NH2	2:B:191[A]:GLU:OE1	2.03	0.91
2:B:230:PRO:HG2	9:B:408:PEG:H32	1.53	0.89
2:B:235:THR:OG1	8:B:403:GOL:H2	1.75	0.86
2:B:146[A]:CYS:SG	10:B:401:NAD:H4N	2.17	0.82
10:B:401:NAD:H2B	9:B:409:PEG:C3	2.10	0.81
1:A:281[A]:TRP:CD1	1:A:283[A]:ASP:HB3	2.15	0.81
1:A:101[B]:ARG:HD3	1:A:105[B]:ARG:HH12	1.46	0.81
1:A:101[B]:ARG:HD2	1:A:105[B]:ARG:HH22	1.44	0.80
1:A:101[B]:ARG:CD	1:A:105[B]:ARG:HH12	1.96	0.77
2:B:266:GLN:HA	8:B:405:GOL:H31	1.67	0.76
10:B:401:NAD:H8A	9:B:409:PEG:H32	1.67	0.76
2:B:173[B]:ILE:HG22	2:B:221:MET:HG3	1.69	0.75

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:233:ALA:HA	9:B:408:PEG:H11	1.69	0.74
1:A:262[B]:GLN:HG2	9:A:408[B]:PEG:C4	2.17	0.74
1:A:101[B]:ARG:HG3	1:A:101[B]:ARG:NH1	1.98	0.73
1:A:262[B]:GLN:HG2	9:A:408[B]:PEG:H42	1.71	0.72
1:A:112:SER:HA	9:A:406:PEG:H42	1.72	0.71
2:B:170:VAL:HB	2:B:224[B]:THR:HG22	1.72	0.71
1:A:271:VAL:HG23	9:A:410:PEG:H21	1.71	0.71
2:B:90[B]:LEU:HD13	2:B:92:PHE:CE1	2.27	0.69
1:A:107:HIS:CD2	9:A:406:PEG:H41	2.28	0.68
9:A:408[B]:PEG:H32	12:A:730:HOH:O	1.92	0.68
1:A:101[B]:ARG:CG	1:A:101[B]:ARG:NH1	2.51	0.67
2:B:146[B]:CYS:HB3	10:B:401:NAD:H4N	1.76	0.66
2:B:90[B]:LEU:HD12	2:B:90[B]:LEU:O	1.96	0.66
2:B:53:MET:HG3	2:B:63:LEU:HD23	1.80	0.63
2:B:268[A]:ARG:HE	8:B:404:GOL:H31	1.63	0.63
2:B:146[A]:CYS:SG	10:B:401:NAD:C5N	2.88	0.62
1:A:281[A]:TRP:HD1	1:A:283[A]:ASP:HB3	1.63	0.60
1:A:101[B]:ARG:HG2	1:A:105[B]:ARG:NH1	2.19	0.58
1:A:93[B]:LEU:HD21	1:A:129[B]:HIS:CE1	2.38	0.58
1:A:266:ALA:HB3	9:A:410:PEG:H41	1.84	0.58
2:B:115[B]:ILE:HD11	2:B:311:LEU:HD12	1.85	0.57
2:B:235:THR:HG21	8:B:405:GOL:H12	1.87	0.57
2:B:92:PHE:CE2	2:B:115[B]:ILE:HD12	2.39	0.56
1:A:274:PRO:HB2	9:A:407:PEG:H41	1.87	0.56
1:A:271:VAL:CG2	9:A:410:PEG:H21	2.34	0.56
2:B:90[B]:LEU:HD12	2:B:90[B]:LEU:C	2.31	0.56
2:B:98[C]:LYS:HD2	12:B:671:HOH:O	2.06	0.56
2:B:266:GLN:HA	8:B:405:GOL:C3	2.36	0.56
1:A:101[B]:ARG:NH1	1:A:101[B]:ARG:HB2	2.20	0.55
1:A:262[B]:GLN:HG2	9:A:408[B]:PEG:C3	2.36	0.55
2:B:180:PRO:HB2	9:B:409:PEG:C4	2.29	0.54
1:A:21:ARG:HD2	1:A:21:ARG:C	2.33	0.53
10:B:401:NAD:O1A	9:B:409:PEG:H41	2.09	0.53
1:A:107:HIS:NE2	9:A:406:PEG:H41	2.23	0.53
1:A:110:GLY:HA2	9:A:406:PEG:H11	1.89	0.53
1:A:129[C]:HIS:ND1	1:A:129[C]:HIS:N	2.52	0.53
2:B:146[B]:CYS:HB3	10:B:401:NAD:C4N	2.38	0.53
10:B:401:NAD:H8A	9:B:409:PEG:C3	2.36	0.53
1:A:153:GLU:OE2	1:A:193[B]:ARG:NH2	2.41	0.52
2:B:42:LEU:O	2:B:45:SER:HB3	2.09	0.52
1:A:112:SER:HB3	9:A:406:PEG:H31	1.91	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:100:VAL:HG23	2:B:187[B]:ASP:OD2	2.10	0.51
2:B:181:GLY:HA2	9:B:409:PEG:H11	1.92	0.50
9:B:409:PEG:H21	12:B:673:HOH:O	2.12	0.50
2:B:39:LEU:HD22	2:B:53:MET:HE3	1.93	0.50
8:B:403:GOL:O3	8:B:405:GOL:H11	2.12	0.50
11:B:410:FOR:C	12:B:510:HOH:O	2.54	0.50
8:B:403:GOL:O3	8:B:405:GOL:C1	2.61	0.48
1:A:13[B]:VAL:HG22	1:A:220:TYR:CD1	2.49	0.48
1:A:101[B]:ARG:NH1	1:A:101[B]:ARG:CB	2.77	0.47
1:A:303[A]:GLU:OE2	12:A:769:HOH:O	2.20	0.47
1:A:116[B]:ILE:HD12	1:A:130:PHE:CD1	2.49	0.47
1:A:129[B]:HIS:NE2	2:B:187[B]:ASP:OD1	2.46	0.47
1:A:189[B]:GLN:NE2	12:A:728:HOH:O	2.48	0.46
1:A:128:GLN:HB2	1:A:129[C]:HIS:CE1	2.51	0.46
1:A:304[B]:ARG:HG3	12:A:616:HOH:O	2.14	0.46
2:B:34:ILE:HD11	10:B:401:NAD:C4N	2.46	0.45
2:B:90[B]:LEU:CD1	2:B:92:PHE:CE1	2.99	0.45
1:A:263:ALA:HA	9:A:408[B]:PEG:H31	1.98	0.45
1:A:214:ALA:O	1:A:217[B]:VAL:HG22	2.19	0.43
1:A:300[B]:LEU:O	1:A:304[B]:ARG:HG3	2.19	0.43
1:A:101[B]:ARG:CD	1:A:105[B]:ARG:NH1	2.73	0.43
1:A:108[B]:ASP:OD1	1:A:108[B]:ASP:O	2.36	0.43
1:A:262[A]:GLN:HB3	9:A:408[A]:PEG:H42	2.00	0.43
2:B:43[B]:GLN:HB2	12:B:584:HOH:O	2.18	0.43
2:B:90[B]:LEU:C	2:B:90[B]:LEU:CD1	2.92	0.42
1:A:329:GLN:HE22	2:B:219[A]:MET:HE1	1.84	0.41
2:B:189:PHE:CD1	2:B:189:PHE:C	2.97	0.41
2:B:170:VAL:HB	2:B:224[B]:THR:CG2	2.46	0.41
1:A:320:VAL:HG13	1:A:325:TYR:HD2	1.85	0.41
1:A:331:ASP:CB	2:B:224[B]:THR:HG21	2.51	0.41
9:A:409:PEG:H42	12:A:763:HOH:O	2.21	0.41
1:A:93[B]:LEU:C	1:A:93[B]:LEU:HD23	2.46	0.41
1:A:101[B]:ARG:CG	1:A:105[B]:ARG:HH12	2.33	0.41
1:A:121:THR:OG1	2:B:214:PRO:HG3	2.20	0.41
2:B:224[B]:THR:O	2:B:224[B]:THR:HG23	2.20	0.40
2:B:282:GLU:OE1	2:B:284[A]:ARG:NH1	2.55	0.40
1:A:300[B]:LEU:HD23	1:A:300[B]:LEU:HA	1.83	0.40
1:A:13[B]:VAL:CG2	1:A:220:TYR:CD1	3.05	0.40
1:A:101[B]:ARG:HH11	1:A:101[B]:ARG:CB	2.33	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	362/355 (102%)	357 (99%)	4 (1%)	1 (0%)	36	18
2	B	316/323 (98%)	308 (98%)	7 (2%)	1 (0%)	36	18
3	N	1/3 (33%)	0	1 (100%)	0	100	100
All	All	679/681 (100%)	665 (98%)	12 (2%)	2 (0%)	36	18

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	181	LEU
2	B	144	ILE

5.3.2 Protein sidechains

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	272/257 (106%)	272 (100%)	0	100	100
2	B	246/245 (100%)	238 (97%)	8 (3%)	33	7
All	All	518/502 (103%)	510 (98%)	8 (2%)	61	31

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	45	SER
2	B	109	GLU

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Mol	Chain	Res	Type
2	B	146[A]	CYS
2	B	146[B]	CYS
2	B	185	ASN
2	B	219[A]	MET
2	B	219[B]	MET
2	B	270	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	318	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 21 ligands modelled in this entry, 3 are monoatomic - leaving 18 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
10	NAD	B	401	-	46,48,48	1.20	6 (13%)	64,73,73	1.49	10 (15%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
8	GOL	B	404	-	5,5,5	0.37	0	5,5,5	0.42	0
9	PEG	A	408[A]	-	6,6,6	0.60	0	5,5,5	0.67	0
8	GOL	B	406	-	5,5,5	0.44	0	5,5,5	0.36	0
9	PEG	A	410	-	6,6,6	0.38	0	5,5,5	0.72	0
9	PEG	A	406	-	6,6,6	0.59	0	5,5,5	0.53	0
8	GOL	B	407	-	5,5,5	0.22	0	5,5,5	0.45	0
9	PEG	B	408	-	6,6,6	0.45	0	5,5,5	0.62	0
4	SO4	A	401	-	4,4,4	0.47	0	6,6,6	0.40	0
8	GOL	B	403	-	5,5,5	0.23	0	5,5,5	0.31	0
9	PEG	A	409	-	6,6,6	0.49	0	5,5,5	0.11	0
8	GOL	B	405	-	5,5,5	0.64	0	5,5,5	1.11	0
11	FOR	B	410	-	0,1,1	-	-	-	-	-
9	PEG	B	409	-	6,6,6	0.39	0	5,5,5	0.35	0
9	PEG	A	408[B]	-	6,6,6	0.50	0	5,5,5	0.13	0
5	PYR	A	402	7	5,5,5	1.54	1 (20%)	3,6,6	1.89	1 (33%)
8	GOL	A	405	-	5,5,5	0.32	0	5,5,5	0.26	0
9	PEG	A	407	-	6,6,6	0.43	0	5,5,5	0.39	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
10	NAD	B	401	-	-	5/30/62/62	0/5/5/5
8	GOL	B	404	-	-	2/4/4/4	-
9	PEG	A	408[A]	-	-	3/4/4/4	-
8	GOL	B	406	-	-	0/4/4/4	-
9	PEG	A	410	-	-	3/4/4/4	-
9	PEG	A	406	-	-	3/4/4/4	-
8	GOL	B	407	-	-	4/4/4/4	-
9	PEG	B	408	-	-	3/4/4/4	-
8	GOL	B	403	-	-	4/4/4/4	-
9	PEG	A	409	-	-	4/4/4/4	-
8	GOL	B	405	-	-	2/4/4/4	-
9	PEG	B	409	-	-	3/4/4/4	-
9	PEG	A	408[B]	-	-	2/4/4/4	-
5	PYR	A	402	7	-	0/4/4/4	-
8	GOL	A	405	-	-	0/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	PEG	A	407	-	-	2/4/4/4	-

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
10	B	401	NAD	C5A-C4A	4.03	1.46	1.39
10	B	401	NAD	O4D-C1D	2.82	1.44	1.40
10	B	401	NAD	C8A-N7A	2.56	1.36	1.31
10	B	401	NAD	C5A-C6A	2.49	1.47	1.41
10	B	401	NAD	C4A-N9A	-2.26	1.33	1.37
5	A	402	PYR	CA-C	-2.25	1.46	1.54
10	B	401	NAD	C5A-N7A	-2.17	1.35	1.39

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	B	401	NAD	C5A-C4A-N3A	-4.10	121.07	126.72
10	B	401	NAD	C4A-N9A-C8A	4.07	110.01	105.74
10	B	401	NAD	N3A-C4A-N9A	3.87	133.75	127.17
10	B	401	NAD	N3A-C2A-N1A	-3.57	123.18	128.58
10	B	401	NAD	N9A-C8A-N7A	-2.92	109.80	113.94
10	B	401	NAD	C2A-N3A-C4A	2.86	118.83	111.83
10	B	401	NAD	C2A-N1A-C6A	2.83	123.38	118.73
5	A	402	PYR	O3-CA-CB	2.50	125.38	119.77
10	B	401	NAD	O4B-C1B-N9A	-2.38	103.52	108.09
10	B	401	NAD	C4A-C5A-N7A	-2.19	108.08	110.58
10	B	401	NAD	C5A-N7A-C8A	2.18	106.88	103.45

There are no chirality outliers.

All (40) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	B	407	GOL	O1-C1-C2-O2
8	B	407	GOL	O1-C1-C2-C3
10	B	401	NAD	O4D-C1D-N1N-C2N
10	B	401	NAD	O4D-C1D-N1N-C6N
10	B	401	NAD	C2D-C1D-N1N-C2N
10	B	401	NAD	C2D-C1D-N1N-C6N
9	A	410	PEG	C1-C2-O2-C3
9	A	407	PEG	O2-C3-C4-O4
9	A	409	PEG	O2-C3-C4-O4

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Mol	Chain	Res	Type	Atoms
9	A	408[A]	PEG	O2-C3-C4-O4
9	B	408	PEG	O1-C1-C2-O2
9	B	408	PEG	O2-C3-C4-O4
9	A	406	PEG	O1-C1-C2-O2
9	A	409	PEG	O1-C1-C2-O2
8	B	403	GOL	O1-C1-C2-C3
8	B	403	GOL	C1-C2-C3-O3
8	B	404	GOL	O1-C1-C2-C3
8	B	405	GOL	O1-C1-C2-C3
8	B	407	GOL	C1-C2-C3-O3
9	A	408[B]	PEG	O1-C1-C2-O2
8	B	405	GOL	O1-C1-C2-O2
8	B	407	GOL	O2-C2-C3-O3
9	B	409	PEG	O2-C3-C4-O4
9	A	408[A]	PEG	O1-C1-C2-O2
9	A	408[B]	PEG	C1-C2-O2-C3
9	A	410	PEG	C4-C3-O2-C2
8	B	403	GOL	O2-C2-C3-O3
8	B	404	GOL	O1-C1-C2-O2
9	A	407	PEG	O1-C1-C2-O2
9	B	409	PEG	C1-C2-O2-C3
8	B	403	GOL	O1-C1-C2-O2
9	A	406	PEG	O2-C3-C4-O4
9	A	410	PEG	O1-C1-C2-O2
9	A	409	PEG	C1-C2-O2-C3
9	A	406	PEG	C4-C3-O2-C2
9	A	409	PEG	C4-C3-O2-C2
9	B	408	PEG	C1-C2-O2-C3
9	B	409	PEG	O1-C1-C2-O2
9	A	408[A]	PEG	C4-C3-O2-C2
10	B	401	NAD	PA-O3-PN-O1N

There are no ring outliers.

13 monomers are involved in 43 short contacts:

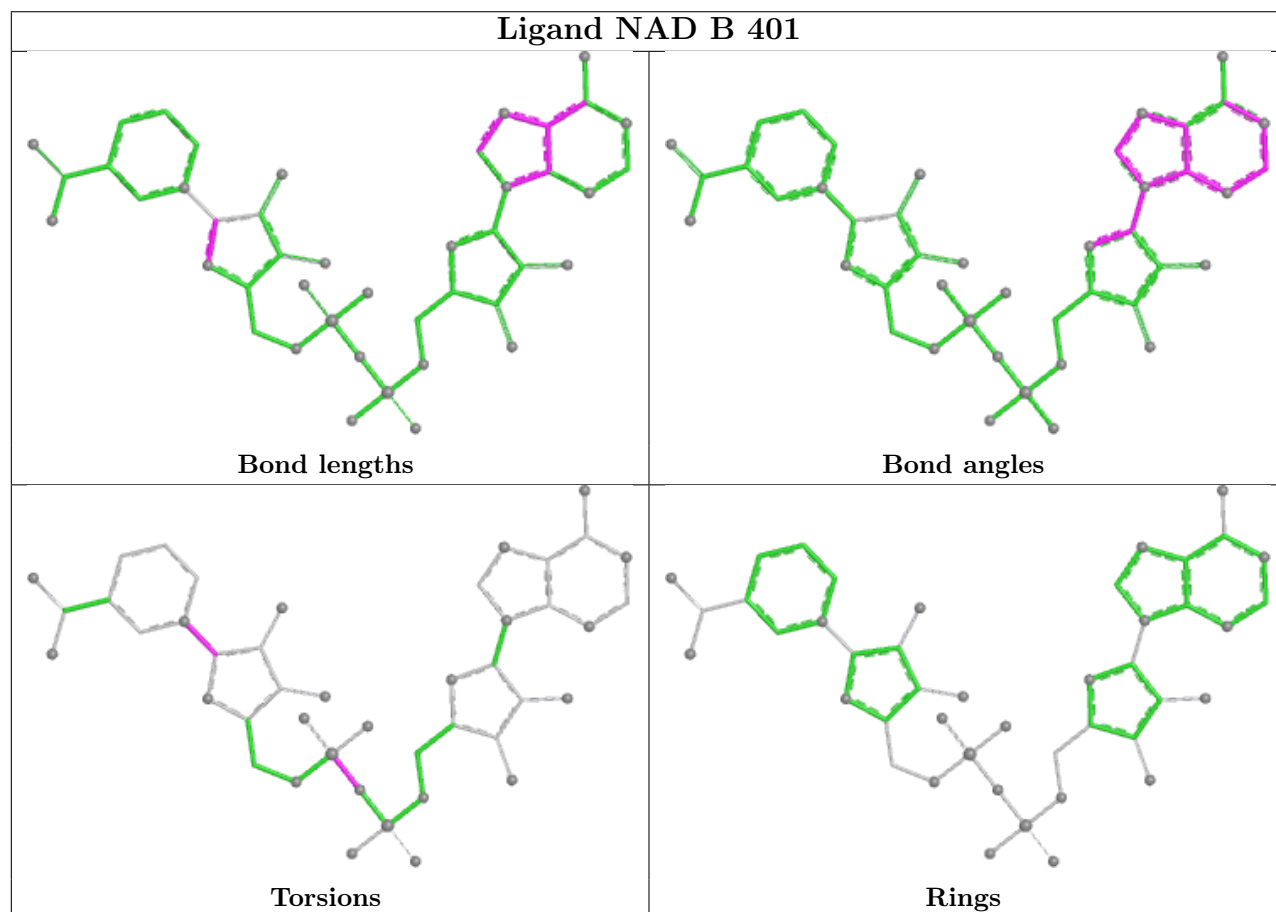
Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	B	401	NAD	11	0
8	B	404	GOL	1	0
9	A	408[A]	PEG	1	0
9	A	410	PEG	3	0
9	A	406	PEG	5	0
9	B	408	PEG	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	B	403	GOL	3	0
9	A	409	PEG	1	0
8	B	405	GOL	5	0
11	B	410	FOR	3	0
9	B	409	PEG	9	0
9	A	408[B]	PEG	5	0
9	A	407	PEG	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ > 2	OWAB(Å ²)	Q < 0.9
1	A	337/355 (94%)	-0.17	3 (0%) 81 86	3, 8, 14, 29	34 (10%)
2	B	294/323 (91%)	-0.04	5 (1%) 69 77	2, 9, 15, 28	31 (10%)
3	N	3/3 (100%)	5.12	3 (100%) 0 0	16, 16, 16, 16	3 (100%)
All	All	634/681 (93%)	-0.08	11 (1%) 69 77	2, 8, 15, 29	68 (10%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	N	157	ALA	6.3
3	N	156	ALA	5.0
3	N	158	ALA	4.1
2	B	315	PRO	4.0
1	A	346	GLY	3.9
2	B	22	GLY	3.9
2	B	284[A]	ARG	3.6
1	A	10	ALA	3.1
2	B	270	ILE	2.5
2	B	314	ALA	2.4
1	A	281[A]	TRP	2.2

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

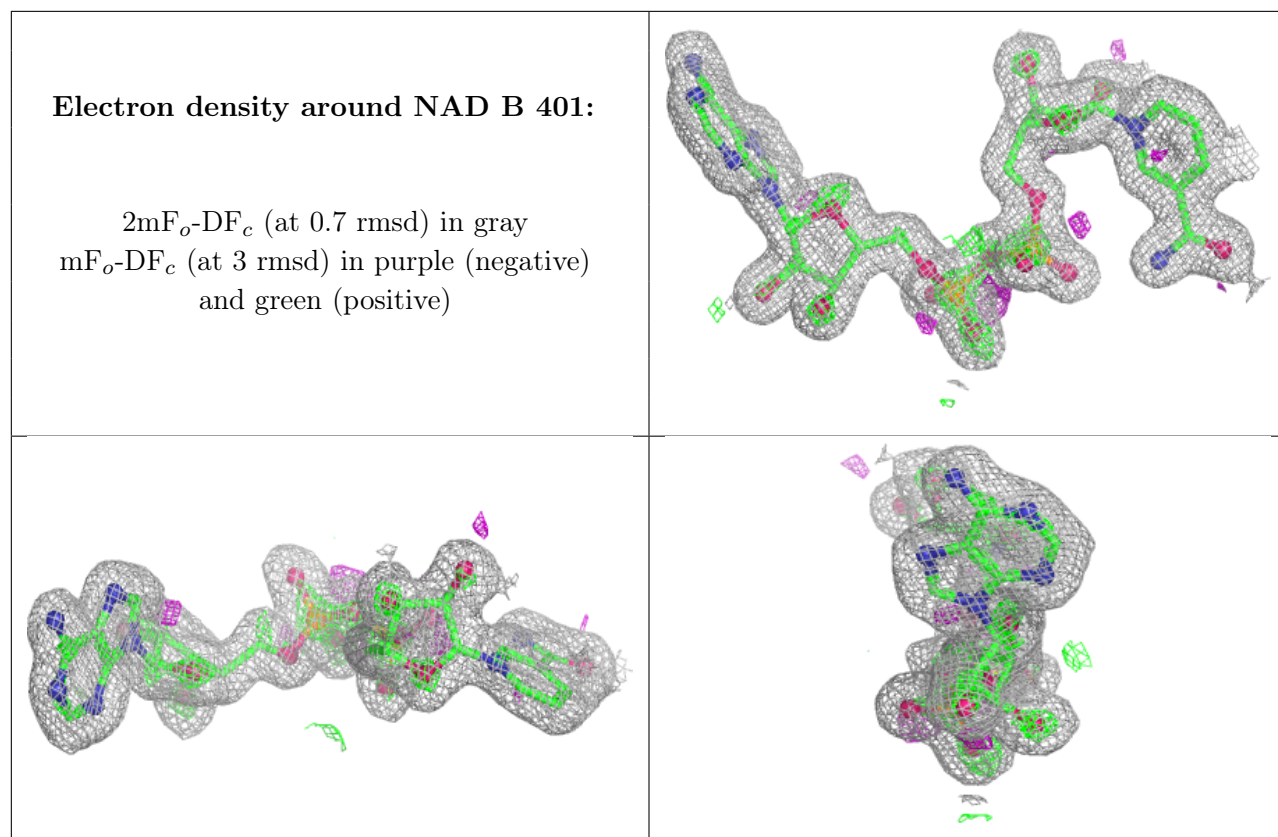
There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
9	PEG	A	407	7/7	0.73	0.19	23,29,31,33	7
8	GOL	B	404	6/6	0.75	0.20	33,44,45,46	6
8	GOL	B	405	6/6	0.76	0.17	22,24,26,28	6
9	PEG	A	408[A]	7/7	0.77	0.16	21,26,33,36	7
9	PEG	A	408[B]	7/7	0.77	0.16	28,29,39,45	7
8	GOL	B	406	6/6	0.78	0.14	37,51,55,59	0
9	PEG	B	408	7/7	0.79	0.14	23,24,37,39	7
9	PEG	A	410	7/7	0.82	0.24	14,16,23,24	7
9	PEG	A	406	7/7	0.84	0.16	19,24,28,36	7
8	GOL	A	405	6/6	0.84	0.16	37,46,48,51	6
9	PEG	A	409	7/7	0.85	0.24	23,28,32,33	7
9	PEG	B	409	7/7	0.85	0.17	21,26,35,36	7
8	GOL	B	403	6/6	0.86	0.18	18,24,31,38	6
8	GOL	B	407	6/6	0.88	0.28	27,36,36,37	6
11	FOR	B	410	2/2	0.91	0.10	20,20,20,23	0
5	PYR	A	402	6/6	0.93	0.11	16,18,24,26	0
4	SO4	A	401	5/5	0.93	0.12	22,24,28,31	5
10	NAD	B	401	44/44	0.97	0.08	16,19,20,24	0
6	CL	B	402	1/1	0.99	0.10	29,29,29,29	0
7	MG	A	404	1/1	0.99	0.28	9,9,9,9	0
6	CL	A	403	1/1	0.99	0.08	24,24,24,24	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



6.5 Other polymers [i](#)

There are no such residues in this entry.